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The Painting of Galvanized Iron

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Painting Galvanized Iron and Other Zinc Surfaces

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Painting Galvanized Iron and Other Zinc Surfaces

THE low cost of maintaining galvanized iron and sheet zinc structures is largely responsible for their choice for industrial building. In the case of galvanized iron, however, the zinc coating is penetrated by the weather in time; this time depending on the quality of the coating and the conditions of exposure. This exposes bare iron and makes it necessary to protect the building by the use of paint. After a galvanized surface has weathered, painting can ordinarily be carried out with complete assurance of good adherence if the proper quality of paint is used. On the other hand, it is often desirable to paint a newly erected galvanized iron or sheet zinc structure for decorative purposes or to follow out a uniform color scheme. Such cases require special consideration.

factors governing adherence of paint to new galvanized iron and sheet zinc surfaces

New galvanized iron and sheet zinc both present a very smooth surface which offers no pores or pits into which a paint can penetrate to obtain mechanical anchorage. Iron sheeting, on the other hand, usually has a rough surface. Furthermore, it is not greatly expanded and contracted by temperature variations. Changes in temperature cause expansion or contraction which is slight in the case of galvanized iron but more marked in the case of sheet zinc. This change has an effect on adherence of paint—especially so on a surface offering no mechanical anchorage. As a result, an ordinary paint may peel in large sheets, leaving the bare metal exposed. Further difficulty may be encountered in painting unweathered zinc surfaces due to the presence of grease or dirt.

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These difficulties can be overcome in a large measure by using the best type of metal priming paint for these surfaces.

weathering galvanized iron and sheet zinc before painting

Weathering for two to six months will ordinarily remove any grease present and at the same time roughen or etch the surface of the metal. This allows the paint to come in direct contact with and wet the metal and, also, provides a slightly roughened surface on which the paint can obtain some mechanical anchorage. This weathering can be supplemented, often to good advantage, by cleaning and etching treatments, but such supplementary treatment as a rule need not be employed. When it is desired to paint a zinc surface before it has weathered, it usually is necessary, before applying paint, to use a method of pretreatment in order to obtain a surface equivalent to one which has been weathered.

pretreating galvanized iron and sheet zinc for painting, and recommendations for cases where pretreating is required

Although widely recommended and used, pretreating methods have not been found wholly satisfactory because chemicals having an etching effect on the metal leave a deposit of water soluble salts. This difficulty can be overcome by completely removing the salts from the pretreated surface by a thorough brushing or washing with clear water. Some pretreating methods give entire satisfaction if properly carried out, and others are of little or no value. Naturally

the most satisfactory pretreating method is one in which cleaning and etching take place in one operation. Suggested methods follow:

(1)—Sand blasting is the most effective treatment for all conditions of the surface. This method cleans and etches in one operation.

(2)—A more practicable and economical method of obtaining a cleaned and etched surface in a single operation from a surface contaminated with grease is to apply liberally, with an oil free brush, an acidified mixture of denatured alcohol, toluol and carbon tetrachloride. This may be prepared approximately as follows:

60 volumes denatured alcohol
30 volumes toluol
5 volumes carbon tetrachloride
5 volumes commercial concentrated hydrochloric acid (muriatic acid)

This treatment is especially effective and is highly recommended.

(3)—Merely washing the surface with toluol, or some solvent in which the oils or greases are soluble, will serve in many cases, and especially for interior work. If the surface is not exposed to extreme temperature changes, a thoroughly cleaned zinc surface provides sufficient anchorage for the paint film, assuming, of course, that the paint is one that can be expected to adhere.

(4)—If the surface has weathered or is originally quite free from oil or grease, brushing with, or dipping the surface in, a solution of copper acetate (6 ounces per gallon) in water etches the surface quite well. The weakness of this method is that it does not dissolve oil or grease and hence will not etch greasy surfaces thoroughly.

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Whenever any pretreating method is used the surfaces should be completely dry and free from dirt, grease and soluble salts before the application of paint. Natural weathering over a period of two to six months has obvious advantages over any of the above treatments. They supplement natural weathering, however, in a very satisfactory manner.

special pretreated galvanized sheets

Galvanized sheet which has been annealed to give a matte

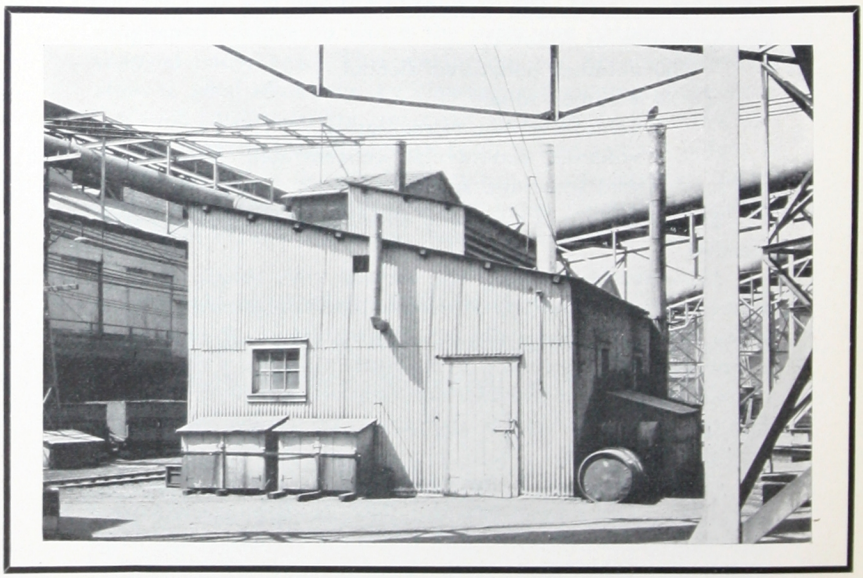

Figure 1
Galvanized Iron Structure Painted With Two Coats Zinc Dust-Zinc Oxide Paint

surface is now on the market. As to paintability it approximates a naturally weathered zinc surface.

paints for galvanized iron and sheet zinc

Extensive tests carried out over a number of years indicate that those paints classed as "Metal Primers" are, as a whole, better adapted for priming zinc surfaces than other general classes of paints. However, a paint for this particular type of service need not be of the rust inhibitor class, as for iron and steel surfaces. The suitability of a paint for zinc surfaces depends largely on its physical properties, while on ordinary iron or steel surface a successful paint must have certain chemical as well as physical properties to prevent corrosion. The outstanding requirements of a paint for zinc surfaces are: (1) that it be highly distensible and retain this property over a long period of exposure to weathering, and (2) that it have the property of thoroughly wetting the surface at least at the outset (whether after the film has oxidized the adherence is greatly influenced by factors other than mechanical gripping of the surface, we are not prepared to say).

scope of tests

During the past few years a large number of tests have been carried out on paints applied to pretreated and untreated sheet zinc and galvanized iron panels, exposed outdoors at a 45° angle facing south. Other tests were carried out on a number of buildings sided with these metals, and on test panels exposed to accelerated weathering. The results of the various methods of testing are in relatively close agreement and may be considered conclusive in as far as they go.

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Figure No. 1 illustrates a galvanized structure painted with two coats of zinc dust-zinc oxide paint. This paint was applied by spray gun five years ago to a weathered galvanized surface. The paint is exposed to particularly severe conditions, the building being located in the smoky and gaseous atmosphere of a large industrial plant. A close inspection of this building revealed absolutely no cracking, scaling or peeling of the paint after five years' exposure.

A section of weathered galvanized iron fence around an industrial plant is illustrated in Figure No. 2. This fence was sprayed with one coat of zinc dust-zinc oxide paint four years ago. Figure No. 3 illustrates a close-up view of a representative section of this fence and clearly shows the excellent condition of the paint after four years' outdoor exposure.

The following key is for the treatments used on the test panels shown in Figures No. 4 to 7 inclusive:

"A" cleaned with benzol but unetched.

"B" treated with copper acetate solution (6 oz. per gal.)

"E" etched with the following mixture:

35 parts (by volume) toluol
65 parts denatured alcohol
5 parts hydrochloric acid

(In subsequent tests the addition of 5 parts carbon tetrachloride was found to speed up the action of this mixture. Hence it is included in the formulae recommended on page 7.)

"F" cleaned with a solution consisting of:

250 cc concentrated sodium carbonate solution
500 cc 3% sodium silicate solution

"G" weathered for three months previous to painting

"H" light sand-blast.

In each case the solutions were applied with an ordinary paint brush. After the panels had dried the soluble salts

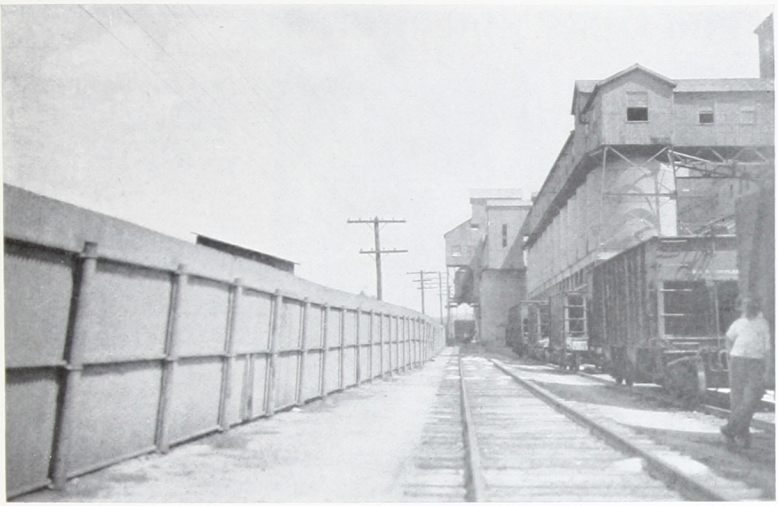


Figure 2
View of Zinc Dust Painted Galvanized Fence Around Industrial Plant

Figure 3
Close-up of a Small Representative Area of Fence
Illustrated in Figure No. 2

Painting Galvanized Iron and Other Zinc Surfaces

were rinsed off with water, following which the panels were again dried carefully before any paint was applied.

Figure No. 4 illustrates a series of galvanized iron test panels exposed for over two years at an angle of 45° facing south. The panels were pretreated as noted above, and then primed with one coat of red lead and second and third coated with two white finish paints. (Zinc Oxide-Lithopone base paint on left half of each panel and white lead on right half of each panel.) It is at once apparent from this illustration that only on the sand-blasted panel "H" is the paint showing any satisfactory degree of adherence. This test indicates that red lead is not a satisfactory primer for untreated or etched galvanized surfaces, with the exception of those that are sand-blasted.

The panels in Figures 4 and 5 were all exposed for the same length of time, and in the same manner. The panels in Figure 5 were untreated and pretreated by the various methods described and painted with an iron oxide-zinc oxide paint, and then finished on each half with two coats of two white finish paints as on the panels in Figure No. 4. This primer is considered very good for galvanized iron, and in the past, has given quite effective service in the plants of the New Jersey Zinc Co. Panels "A," "E," "G," and "H" are reasonably free from peeling, "H" being by far the outstanding panel of the set. Here, with the exception of "E" the chemically etched panels show most evidence of failure. These panels are considerably superior to those appearing in Fig. 4.

Figure No. 6 illustrates a series of treated galvanized iron panels primed with a zinc dust-zinc oxide paint, described in the bulletin "Metallic Zinc Powder in Industrial Paint."

Representative galvanized iron panels of a test series after 2¼ years' exposure at a 45° angle facing south.

The primer is a commercial pure red lead paint.

Left Half—Finished with two coats of a Zinc Oxide - Lithopone Paint.

Right Half — Finished with two coats of white lead paint.

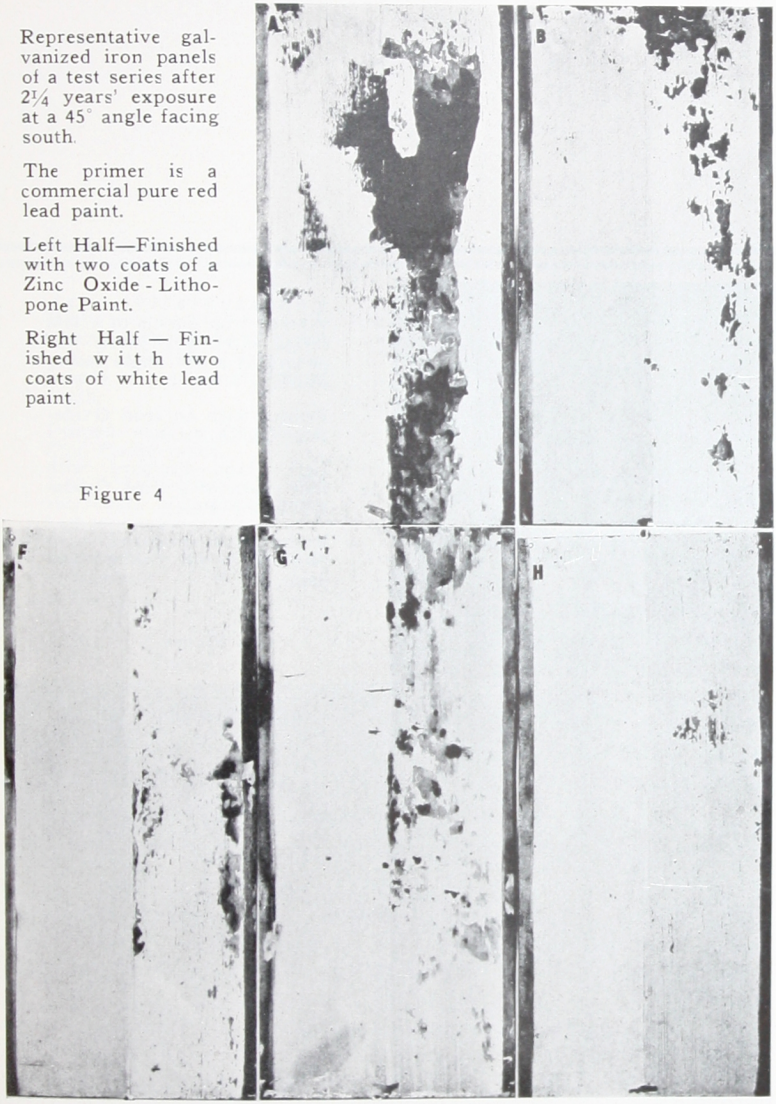
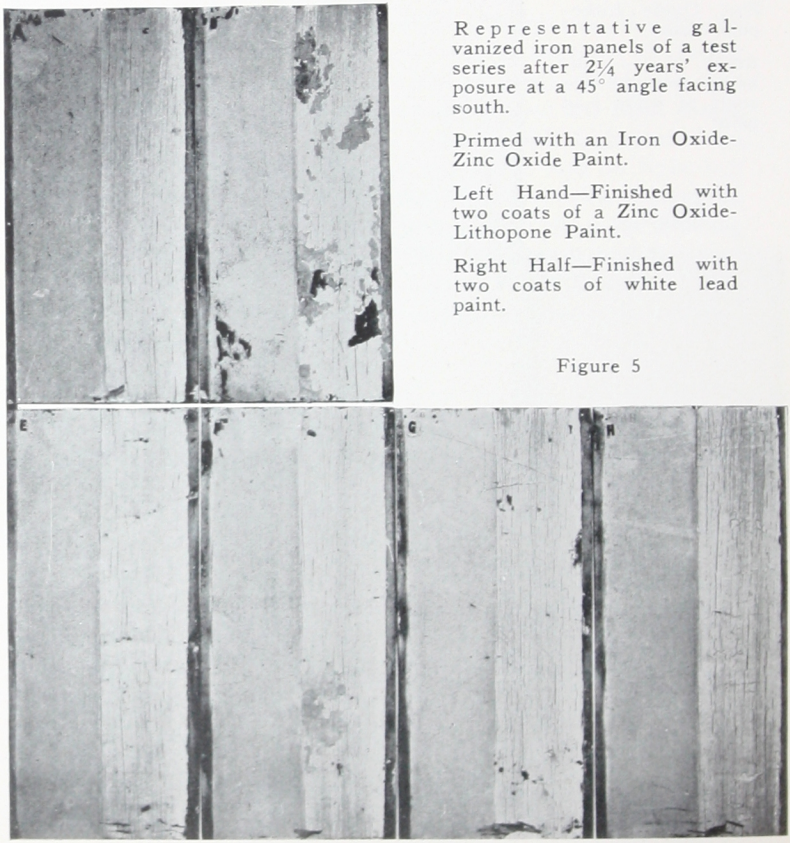


Figure 4

Painting Galvanized Iron and Other Zinc Surfaces



Representative galvanized iron panels of a test series after 2¼ years' exposure at a 45° angle facing south.

Primed with an Iron Oxide-Zinc Oxide Paint.

Left Hand—Finished with two coats of a Zinc Oxide-Lithopone Paint.

Right Half—Finished with two coats of white lead paint.

Figure 5

Representative galvanized iron panels of a test series after 2¼ years' exposure at a 45° angle facing south.

Primed with a Zinc Dust-Zinc Oxide paint.

Left Half—Finished with two coats of a Zinc-Oxide-Lithopone Paint.

Right Half—Finished with two coats of white lead paint.

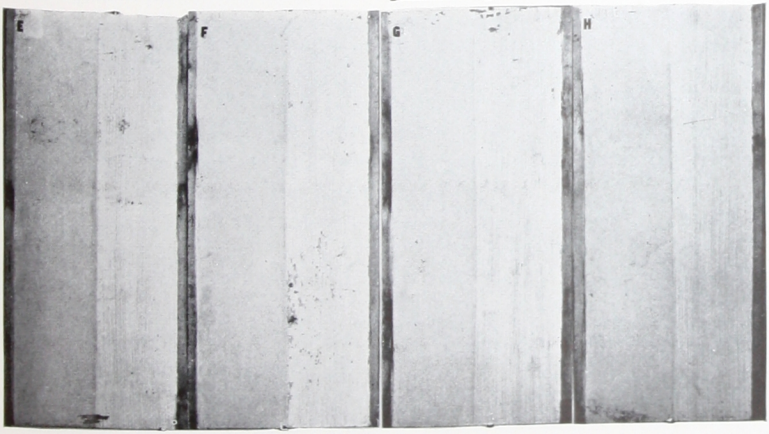


Figure 6

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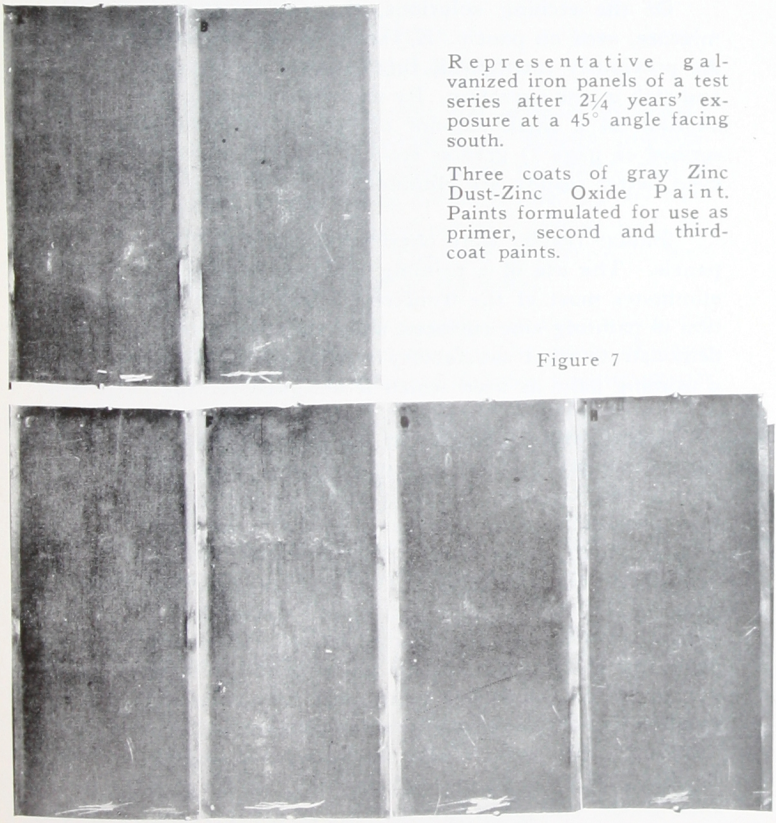
The finishing coats are the same as used on the panels in the preceding illustrations. These panels are pretreated in the same manner as the other series of panels and were also exposed for over two years to weathering at an angle of 45° facing south. It is quite apparent that the condition of the paints on these panels is by far superior to the other paints on the panels in the preceding photographs. Compared with the other paints, panels "A," "E," "G," and "H" in this set are in excellent condition. These panels are outstanding, with the sand-blasted and weathered panels generally in better condition than the chemically etched surfaces, excepting "E." Throughout our experience zinc dust-zinc oxide paint has shown unusual adhering properties to new galvanized iron that had no treatment or weathering whatsoever prior to painting. Zinc dust-zinc-oxide paint adheres better on such surfaces than many other primers do over treated surfaces.

The galvanized iron panels illustrated in Figure No. 7 were treated and painted throughout with three coats of the zinc dust-zinc oxide paint referred to above. Their superiority over the rest is at once apparent, there being absolutely no evidence of peeling on any panel. (The light spots on the photograph are caused by high lights.) Scratch tests, made with a knife, indicate that the adherence on the unetched surface "A" is equally as satisfactory as the adherence on the chemically etched surface. Of the chemically etched surfaces "E" ranks first.

This series of panels offers the interesting possibility that when zinc dust-zinc oxide primer is used, etching by chemical methods becomes less essential, providing the surface is clean and dry. Mechanical roughening of the surface by sand-blast-



Representative galvanized iron panels of a test series after 2¼ years' exposure at a 45° angle facing south.

Three coats of gray Zinc Dust-Zinc Oxide Paint. Paints formulated for use as primer, second and third-coat paints.

Figure 7

Painting Galvanized Iron and Other Zinc Surfaces

ing will, of course, produce results surperior to those obtained on either weathered or chemically etched surfaces.

Of the etching solutions, the acidulated toluol-alcohol mixture, used on panels "E," seems to be in a class by itself. As previously mentioned, this mixture is designed to clean and etch in one operation. By slightly modifying this with the addition of a small amount of carbon tetrachloride (as described on page 7) greater etching efficiency is developed and even better results are obtained.

Similar results were obtained in tests run on zinc sheet panels. The use of a priming paint adapted to the purpose eliminates most of the troubles. There should be no hesitation in painting zinc surfaces, since the tests mentioned above demonstrate what satisfactory results can be obtained where a priming paint is used which is designed for the purpose.

Commercial application at the plants of The New Jersey Zinc Company and others corroborates these observations. In painting ordinary black iron for permanent results, certain precautions must be taken, i.e., the surface must be dry, and free from grease, dirt and loose scale. Also, paint must be selected that adheres, is rust resisting and durable. In painting zinc surfaces, no less attention can be given to the factors governing good painting practice. In addition, a paint should be chosen that has the added property of adhering to a zinc surface—and it is quite clear that a paint that gives good results on black iron does not necessarily have the qualifications necessary for a paint for galvanized surfaces. Metallic Zinc Powder (Zinc Dust) in paint, in combination with Zinc Oxide, has given satisfaction for many years, as it has the qualifications essential for the successful painting of both

galvanized and sheet zinc surfaces—and incidentally black iron.

lacquering and enameling sheet, cast zinc, and galvanized iron surfaces

The use of quick drying enamels and lacquers for coating zinc surfaces presents a somewhat more difficult problem. Ordinarily they cannot be depended upon to adhere well to such metallic surfaces when these are untreated. In any case, far more satisfactory results are obtained if zinc surfaces are coated with oil base primers. The best procedure in such cases is to bake the priming coat on the metal.

Before the application of any coating to the surface, the metal should be thoroughly cleaned. The most effective method is to immerse the article in a cleaning solution of the following composition:

200 cc Water
30 grams tri-sodium phosphate
4 grams sodium hydroxide

This solution should be used at a temperature of 70° to 80°C and be stirred with a motor agitator. After rinsing (hot water) the surface may be etched by immersing from ¼ to ½ minutes (one minute is suggested in the case of sheet zinc or zinc articles) in a solution of the following composition:

1,000 cc water
200 cc hydrochloric acid (commercial muriatic acid)
20 grams ammonium nitrate

Rinse with water and dry thoroughly before coating. It is important to remove all water soluble salts.

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Good results can also be obtained by brushing on the surface the denatured alcohol mixture described under (2) Page 7. The very best results are produced by roughening the surface by some mechanical means such as a light sand blast. This treatment is suggested whenever possible.

conclusions

Some question remains as to the best method of treating zinc surfaces—both galvanized and sheet zinc—before painting. However, many tests and observations seem to prove that:

1. Zinc surfaces need pretreatment when most priming paints are used.

2. Certain methods of pretreatment, particularly sandblasting and natural weathering, give best results with any paint.

3. Chemical etching is less effective, but has the advantage of being quicker than weathering and less costly than sandblasting. The denatured alcohol mixture described is recommended for use.

4. There are priming paints available which give satisfactory results on treated or untreated zinc surfaces, assuming that the latter are clean and dry. Experience and close observation have shown that zinc dust-zinc oxide paints are eminently efficient.

5. There need be no more hesitation in painting zinc surfaces than in painting any other metallic surface, if priming paints are properly selected and the usual precautions are taken that apply in the painting of any metal.

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